1-34(inh.)
5-8
11,17,18
19 22 23
25-30

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-330031

(43)Date of publication of application : 30.11.1999

(51)Int.Cl. H01L 21/304
B08B 3/08
H01L 21/306
H01L 21/68

(21)Application number : 10-126391

(22)Date of filing : 08.05.1998

(71)Applicant : DAINIPPON SCREEN MFG CO LTD

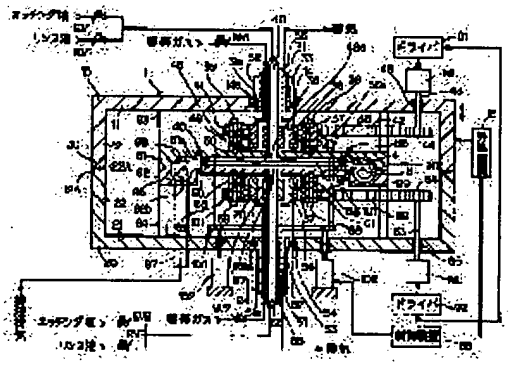
(72)Inventor : MIYA KATSUHIKO
MURAOKA YUSUKE
IZUMI AKIRA

(54) SUBSTRATE PROCESSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To perform uniform processing to a substrate.

SOLUTION: A wafer W is held by holding a peripheral edge part between interposed supporting members 4 and 6 provided at the respective peripheral edge parts of a shield plate 40 and a base plate 60. Respective discharging ports 48a and 68a of cleaning liquid nozzles 48 and 68 face the upper and lower surfaces of the wafer W from openings 47 and 67 at the centers of the shield plates 40 and 60. The shield plates 40 and 60 are integrally rotated by getting rotational force from motors MU and ML, and in such a state, that cleaning liquid is supplied from the cleaning liquid nozzles 48 and 69 onto the upper and lower surfaces of the wafer W. Therefore, wince intervals between the upper and lower surfaces of the wafer W and the shield plate and base plate 40 and 60 can be surely regulated to a constant level, and uniform processing can be applied to plural wafers.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the substrate processor which supplies processing liquid on the surface of a substrate, rotating a substrate The 1st substrate opposite member which has the larger 1st substrate opposed face than the magnitude of a substrate, The 2nd substrate opposite member in which the above-mentioned 1st substrate opposed face is countered, and the magnitude has the larger 2nd substrate opposed face than the magnitude of a substrate, the contiguity location where the above-mentioned 1st substrate opposed face approached the above-mentioned 2nd substrate opposed face, and the alienation which the above-mentioned 1st substrate opposed face estranged from the above-mentioned 2nd substrate opposed face -- between locations The migration means to which the above-mentioned 1st substrate opposite member is relatively moved to the above-mentioned 2nd substrate opposite member, and when it is prepared in the above-mentioned 1st substrate opposite member and this 1st substrate opposite member is in the above-mentioned contiguity location When one principal plane of a substrate is contacted, it is prepared in the 1st mediation supporter material which holds uniformly spacing of the above-mentioned 1st substrate opposite member and the principal plane of the method of substrate top Norikazu, and the above-mentioned 2nd substrate opposite member and the above-mentioned 1st substrate opposite member is in the above-mentioned contiguity location While contacting the principal plane of another side of a substrate and holding uniformly spacing of the above-mentioned 2nd substrate opposite member and the principal plane of above-mentioned another side of a substrate The 2nd mediation supporter material which pinches a substrate between the above-mentioned 1st mediation supporter material, The substrate processor characterized by having a processing liquid supply means to supply processing liquid to the front face of the substrate currently pinched by the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material, and the rotation driving means which carries out the rotation drive of the above-mentioned 1st substrate opposite member and the 2nd substrate opposite member in one.
[Claim 2] The above-mentioned 1st mediation supporter material and the 2nd mediation supporter material are a substrate processor according to claim 1 characterized by being prepared in the above-mentioned 1st substrate opposite member and the 2nd substrate opposite member, respectively so that the periphery section of a substrate may be pinched, when the above-mentioned 1st substrate opposite member is in the above-mentioned contiguity location.
[Claim 3] The above-mentioned processing liquid supply means is a substrate processor according to claim 1 or 2 characterized by including the processing liquid nozzle of the above-mentioned 1st substrate opposed face which is mostly arranged in the center and carries out the regurgitation of the processing liquid towards one principal plane of the above-mentioned substrate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the substrate processor which supplies predetermined processing liquid to the front face of a substrate, and processes a substrate, rotating substrates, such as substrates for flat-panel displays (FPD), such as a semi-conductor substrate and a liquid crystal display dexterous substrate, and a glass substrate for photo masks.
[0002]
[Description of the Prior Art] In the production process of a semiconductor device, the front rear face of a semi-conductor wafer (only henceforth a "wafer") is washed if needed. An example of the sheet mold substrate washing station which washes one wafer at a time is indicated by JP,9-330904,A. The substrate washing station currently indicated by this official report is equipped with a disc-like base member, the revolving shaft of the hollow which supports this base member horizontally, the bottom nozzle that is arranged in this revolving shaft and carries out the regurgitation of the penetrant remover towards the upper part from the center of a base member, the disc-like covered member arranged possible [rotation and rise and fall] [above a base member], and the upper nozzle which turns caudad from the center of this covered member, and carries out the regurgitation of the penetrant remover. The attachment component 5 which holds a wafer in respect of a peripheral edge is arranged on the top face of a base member.
[0003] On the occasion of washing of a wafer, it is in the condition of having made the wafer holding to the attachment component of a base member, and a revolving shaft is rotated. Moreover, a covered member is dropped to the location close to the top face of a wafer, and is rotated at a base member and uniform velocity. And a penetrant remover is breathed out towards the core of the vertical side of a wafer from an upper nozzle and a bottom nozzle. For example, drug solutions, such as fluoric acid and aqueous ammonia, are breathed out as a penetrant remover, and the pure water for flushing the drug solution adhering to a wafer is breathed out as a penetrant remover after that at the period in early stages of washing initiation. The penetrant remover supplied in the center of each of the vertical side of a wafer is led to the periphery section of a wafer according to the centrifugal force accompanying rotation of a wafer, and, thereby, uniform washing of the vertical side of a wafer is attained.
[0004] If washing of the wafer using a penetrant remover is completed, while it had made rotation of a base member and a covered member continue, the regurgitation of the penetrant remover from an up-and-down nozzle will be stopped, and inert gas, such as nitrogen gas, will be supplied to the top-face side of a wafer. Thereby, preventing forming an oxide film etc. on the surface of a wafer, a centrifugal force is used and shaken off and desiccation is performed.
[0005] Since washing and desiccation of a wafer are performed in the space where it was restricted between the base member and the covered member according to this configuration, adhesion of a pollutant to a wafer can be controlled. Moreover, since the distance of an up-and-down nozzle and a wafer is short when a hot drug solution should be supplied to a wafer, the drug solution of desired temperature can be supplied to a wafer, and a good cleaning effect can be acquired. Furthermore, inert

gas can permute the surrounding air of a wafer with a certain extent effectiveness target at the time of desiccation processing, and growth of an oxide film [**** / un-] can be controlled.
[0006]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned advanced technology, chiefly, since spacing of a base member and a covered member is defined only by rise-and-fall control of a covered member, it cannot necessarily hold this spacing uniformly. Therefore, for every wafer, spacing of a base member and a covered member will differ and there is a problem that uniform processing cannot be performed to two or more wafers.
[0007] Moreover, since there is a possibility that a wafer may be damaged when a wafer and a covered member collide during rotation, a covered member needs to secure and arrange sufficient distance from a wafer. Therefore, upper space of a wafer cannot fully be restricted but there is a possibility that the antisticking effectiveness of a pollutant can become inadequate or the circumference of a wafer cannot be made into sufficient inert gas ambient atmosphere.
[0008] Furthermore, in the above-mentioned advanced technology, since the attachment component prepared in the base member must be driven between the condition of holding a wafer, and the discharge condition, of which this maintenance was canceled, the drive for it is required for it. However, since an attachment component will rotate with a base member, it is necessary to incorporate some drives [at least] in a revolving shaft, and this complicates the configuration of the circumference of a revolving shaft.
[0009] Then, the purpose of this invention is offering the substrate processor which can solve an above-mentioned technical technical problem and can perform processing to a substrate good.
[0010] The more concrete purpose of this invention is offering the substrate processor which can perform uniform processing to a substrate.
[0011] Moreover, other concrete purposes of this invention are offering the substrate processor which can perform quality processing to a substrate by restricting the surrounding space of a substrate effectively.
[0012] Moreover, the purpose of further others of this invention is offering the substrate processor which can hold a substrate and can rotate with an easy configuration.
[0013]
[The means for solving a technical problem and an effect of the invention] Invention according to claim 1 for attaining the above-mentioned purpose In the substrate processor which supplies processing liquid on the surface of a substrate, rotating a substrate The 1st substrate opposite member which has the larger 1st substrate opposed face than the magnitude of a substrate, The 2nd substrate opposite member in which the above-mentioned 1st substrate opposed face is countered, and the magnitude has the larger 2nd substrate opposed face than the magnitude of a substrate, the contiguity location where the above-mentioned 1st substrate opposed face approached the above-mentioned 2nd substrate opposed face, and the alienation which the above-mentioned 1st substrate opposed face estranged from the above-mentioned 2nd substrate opposed face -- between locations The migration means to which the above-mentioned 1st substrate opposite member is relatively moved to the above-mentioned 2nd substrate opposite member, and when it is prepared in the above-mentioned 1st substrate opposite member and this 1st substrate opposite member is in the above-mentioned contiguity location When one principal plane of a substrate is contacted, it is prepared in the 1st mediation supporter material which holds uniformly spacing of the above-mentioned 1st substrate opposite member and the principal plane of the method of substrate top Norikazu, and the above-mentioned 2nd substrate opposite member and the above-mentioned 1st substrate opposite member is in the above-mentioned contiguity location While contacting the principal plane of another side of a substrate and holding uniformly spacing of the above-mentioned 2nd substrate opposite member and the principal plane of above-mentioned another side of a substrate The 2nd mediation supporter material which pinches a substrate between the above-mentioned 1st mediation supporter material, It is the substrate processor characterized by having a processing liquid supply means to supply processing liquid to the front face of the substrate currently pinched by the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material, and the

rotation driving means which carries out the rotation drive of the above-mentioned 1st substrate opposite member and the 2nd substrate opposite member in one.

[0014] According to the above-mentioned configuration, each spacing of both the principal planes of a substrate and the 1st and 2nd substrate opposed face is certainly prescribed by when the 1st mediation supporter material and the 2nd mediation supporter material pinch a substrate respectively in contact with both the principal planes of a substrate. Therefore, this spacing becomes fixed to all substrates, when processing two or more substrates. Therefore, processing to two or more substrates can be carried out to homogeneity.

[0015] Moreover, since spacing of the 1st and 2nd substrate opposed face and a substrate is specified certainly, it is easy to make this spacing small, therefore it can restrict effectively the space between the 1st and 2nd substrate opposed faces. Thereby, high-definition processing can be performed to a substrate in this restricted space. That is, for example, it can prevent that surrounding particle adheres to a substrate.

[0016] Furthermore, since pinching of a substrate can be canceled by pinching a substrate between the 1st and 2nd mediation supporter material, and making the 1st and 2nd substrate opposite member of each other isolate by making the 1st substrate opposite member and the 2nd substrate opposite member approach mutually, the configuration for maintenance of a substrate and discharge is very easy. And since it is convenient to maintenance and its discharge of a substrate even if the 1st and 2nd mediation supporter material is being fixed to the 1st and 2nd substrate opposite member, respectively, the drive for driving the 1st and 2nd mediation supporter material to the 1st and 2nd opposite member is not needed. Therefore, the configuration relevant to a rotation driving means can be simplified especially.

[0017] In addition, although each of above-mentioned 1st substrate opposite members and 2nd substrate opposite members may be massive, it is desirable that one side or both are plate-like part material.

[0018] moreover, the above -- alienation -- in a location, although spacing of the 1st substrate opposed face and the 2nd substrate opposed face is large, it is more desirable than the time of the 1st substrate opposite member being in the above-mentioned contiguity location that it is spacing with this sufficient spacing to carry in / take out a substrate between the 1st substrate opposed face and the 2nd substrate opposed face.

[0019] Furthermore, as for the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material, it is desirable that one side or both consist of spring materials.

[0020] Moreover, as for the 1st mediation supporter material, it is desirable to be arranged by the 1st substrate opposed face of the 1st substrate opposite member, and, as for the 2nd mediation supporter material, it is desirable similarly to be arranged by the 2nd substrate opposed face of the 2nd substrate opposite member.

[0021] Invention according to claim 2 is a substrate processor according to claim 1 characterized by preparing the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material in the above-mentioned 1st substrate opposite member and the 2nd substrate opposite member, respectively so that the periphery section of a substrate may be pinched, when the above-mentioned 1st substrate opposite member is in the above-mentioned contiguity location.

[0022] According to the above-mentioned configuration, though particle transfers from the 1st and 2nd mediation supporter material to a substrate, there is no possibility that particle may transfer to the central field of a substrate.

[0023] in addition -- for example, -- the case where the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material pinch the periphery section of a substrate from the upper and lower sides -- either -- it is desirable that the supporter which supports the inferior surface of tongue of the periphery section of a substrate, and the slideway which counters the end face of a substrate and shows a substrate to the above-mentioned supporter are prepared in the mediation supporter material which will be located below. moreover, the inside of the above-mentioned 1st mediation supporter material and the 2nd mediation supporter material -- either -- it is still more desirable if it has the taper side for turning and showing the above-mentioned substrate to the center of rotation to the mediation supporter material which will be located up.

[0024] Moreover, processing liquid can be made to flow into a way out of between the mediation supporter material which it is desirable that open spacing in the periphery section of a substrate and more than one are arranged as for the 1st and 2nd mediation supporter material, and adjoins by this outside a substrate.
[0025] Invention according to claim 3 is a substrate processor according to claim 1 or 2 characterized by the above-mentioned processing liquid supply means containing the processing liquid nozzle of the above-mentioned 1st substrate opposed face which is mostly arranged in the center and carries out the regurgitation of the processing liquid towards one principal plane of the above-mentioned substrate.
[0026] According to the above-mentioned configuration, the processing liquid of one principal plane of a substrate supplied in this center since processing liquid was mostly supplied in the center spreads toward the method of the outside of the radius-of-gyration direction according to the centrifugal force accompanying rotation of a substrate. Thereby, the principal plane of the method of substrate top Norikazu can be processed to homogeneity.
[0027] And in this invention, since it is possible to arrange the 1st substrate opposed face near the pole of a substrate as mentioned above, it is possible to arrange the delivery of a processing liquid nozzle near the pole of the center of a substrate. Therefore, since there is almost no temperature change of the processing liquid which can be set by the time it can perform processing to a substrate good and results [from a processing liquid nozzle] in the principal plane of a substrate, since the rebound phenomenon in the substrate front face of processing liquid does not arise, a substrate with the processing liquid by which temperature management is carried out can be processed good.
[0028] In addition, the above-mentioned processing liquid supply means may contain further the processing liquid nozzle of the above-mentioned 2nd substrate opposed face which is mostly arranged in the center and carries out the regurgitation of the processing liquid towards the principal plane of another side of the above-mentioned substrate.
[0029] A processing liquid nozzle may have the delivery of the front face of a substrate which faces in the center mostly from the processing liquid path which inserts in a substrate opposite member, and opening of a substrate opposed face mostly formed in the center.
[0030] Moreover, the substrate processor of this invention may be a substrate washing station which supplies a penetrant remover to a substrate and washes a substrate.
[0031] Furthermore, the substrate processors of this invention may be substrate washing and a dryer with which swing OFF dries the liquid component of the front face of a substrate by carrying out the rotation drive of the above-mentioned 1st substrate opposite member and the 2nd substrate opposite member in one, where supply of a penetrant remover is suspended. In this case, it is desirable to have an inert gas supply means to supply inert gas to the substrate pinched by the above-mentioned 1st and 2nd mediation supporter material.
[0032]
[Embodiment of the Invention] Below, the gestalt of implementation of this invention is explained to a detail with reference to an accompanying drawing.
[0033] Drawing 1 is the sectional view showing the configuration of the substrate processor concerning 1 operation gestalt of this invention. This substrate processor is sheet mold substrate washing and a dryer for washing one wafer W as a substrate at a time, and drying.
[0034] This substrate processor is equipped with the processing chamber 1 formed possible [division] up and down of the pair of the upper cup 10 and the bottom cup 20. The upper cup 10 is equipped with the disc-like ceiling wall 11 and the side attachment wall 12 of the shape of a cylinder which hung down from the perimeter of the periphery section of this ceiling wall 11, and goes up and down by the elevator style 13 (migration means). Moreover, the bottom cup 20 is equipped with the disc-like bottom wall 21 and the side attachment wall 22 of the shape of a cylinder which started from the perimeter of the periphery section of this bottom wall 21, and is being fixed to the frame (not shown) of equipment.
[0035] It has countered so that lower limit side 12A of the side attachment wall 12 of the upper cup 10 and upper limit side 22A of the side attachment wall 22 of the bottom cup 20 can be mutually close, and in the condition that it was close in lower limit side 12A and upper limit side 22A, the airtightness of the

building envelope of the processing chamber 1 is guaranteed with O ring 30 infixed among these.
[0036] When the upper cup 10 is raised to an upper evacuation location rather than the location of illustration when Wafer W is taken in and out of the processing chamber 1 by the substrate carrier robot which does not illustrate, and processing to Wafer W is performed, the elevator style 13 holds the condition of having dropped the processing location of illustration of the upper cup 10, and secures the airtightness of the building envelope of the processing chamber 1.
[0037] Opening 14 is formed near the center of the ceiling wall 11 of the upper cup 10, and the inlet-port section of a jet pipe 31 is arranged at this opening 14. Between flange 31a of this jet pipe 31, and inner skin 14a of opening 14, the support cylinder 32 is held through O rings 33 and 34. This support cylinder 32 is being fixed to the upper cup 10 by the fixed device which is not illustrated. The flueway (not shown) for leading the internal ambient atmosphere of the processing chamber 1 to a jet pipe 31 is formed in the proper place of the support cylinder 32 which attends the building envelope of the processing chamber 1.
[0038] A jet pipe 31 is inserted in and the nitrogen gas dust 35 for drawing the nitrogen gas as inert gas is arranged. The lower limit section of this nitrogen gas dust 35 is further led to the way among the processing chambers 1 rather than the lower limit section of a jet pipe 31, and the skirt-board section 36 of a major diameter is formed in this lower limit section rather than the nitrogen gas dust 35. This skirt-board section 36 is connected with the above-mentioned support cylinder 32, and, thereby, the skirt-board section 36 is being fixed to the upper cup 10. Outward flange 36a is formed in the lower limit of the peripheral face of the skirt-board section 36, and the bearing 37 is inserted in the peripheral face of the skirt-board section 36 [above this flange 36a]. This bearing 37 is inserted in the inner skin of a tumbling barrel 38, and is supporting this tumbling barrel 38 free [rotation] to the skirt-board section 36 again.
[0039] The disc-like larger shield 40 (the 1st substrate opposite member) a little than Wafer W is being fixed to the lower limit side of a tumbling barrel 38 with the bolt 39. Moreover, the gear member 41 is being fixed to the peripheral face of a tumbling barrel 38. A timing belt 42 is almost wound around this gear member 41. This timing belt 42 has geared to the pulley 44 fixed to the driving shaft 43 of Motor MU, and transmits rotation of this motor MU to a tumbling barrel 38. Motor MU is attached in the upper cup 10 using the suitable installation device (not shown). In addition, 45 is a seal member for holding the inside of the processing chamber 1 airtightly, permitting rotation of a driving shaft 43, and 46 is a spacer for holding spacing of a bearing 37 and a shield 40.
[0040] Opening 47 is formed in the center of a shield 40. In this opening 47, delivery 48a of the penetrant remover nozzle 48 (processing liquid nozzle) which has inserted in the nitrogen gas dust 35 is arranged. Between delivery 48a and opening 47, the clearance is secured and this clearance serves as the nitrogen gas nozzle 50 (nitrogen gas supply means) for carrying out the regurgitation of the nitrogen gas drawn through the skirt-board section 36 from the nitrogen gas dust 35. In order to prevent leakage of the nitrogen gas from the skirt-board section 36 to a tumbling barrel 38 side, labyrinth packing 49 is formed between the lower limit side of the skirt-board section 36, and the top face of a shield 40.
[0041] The disc-like bigger base plate 60 (the 2nd substrate opposite member) a little than Wafer W is arranged so that a shield 40 may be countered from a lower part. This base plate 60 is being fixed to that inferior-surface-of-tongue side by the tumbling barrel 58 with the bolt 59. This tumbling barrel 58 is supported by the peripheral face of the skirt-board section 56 free [rotation] through the bearing 57 inserted in that inner skin. This skirt-board section 56 is formed in the upper limit section of the nitrogen gas dust 55 for introducing nitrogen gas, and is formed in the major diameter rather than this nitrogen gas dust 55.
[0042] The nitrogen gas dust 55 inserts in the jet pipe 51 connected to the exhaust air facility which is not illustrated, and is prepared. This jet pipe 51 is formed so that an inlet port may be arranged at the opening 24 formed in the center of the bottom wall 21 of the bottom cup 20. And between flange 51a of the inlet-port section of this jet pipe 51, and the inner skin of opening 24, the support cylinder 52 is pinched in the condition of having made the seal members 53 and 54 intervening. This support cylinder 52 is connected with the skirt-board section 56 by it while being fixed to the bottom cup 20 by the fixed

device which is not illustrated. Thereby, the skirt-board section 56 is being fixed to the bottom cup 20. The flueway for leading the ambient atmosphere in the processing chamber 1 to a jet pipe 51 is formed in the proper place which attends the building envelope of the processing chamber 1 in the support cylinder 52.

[0043] The gear section 61 is being fixed to the peripheral face of the tumbling barrel 58 currently supported free [rotation] to the skirt-board section 56. A timing belt 62 is almost wound around this gear section 61, and this timing belt 62 is further wound around the pulley 64 fixed to the driving shaft 63 of Motor ML almost. Therefore, when Motor ML is driven, a tumbling barrel 58 will rotate and the base plate 60 will rotate in connection with this. In addition, 65 is a seal member for holding the inside of the processing chamber 1 airtightly, permitting rotation of a driving shaft 63, and 66 is a spacer holding spacing of a bearing 57 and the base plate 60.

[0044] In the nitrogen gas dust 55, the penetrant remover nozzle 68 (processing liquid nozzle) for supplying a penetrant remover to Wafer W has inserted in. Delivery 68a of the upper limit of this penetrant remover nozzle 68 is faced in the center of the inferior surface of tongue of Wafer W through the opening 67 formed in the center of the base plate 60. The clearance is formed between opening 67 and delivery 68a, and this clearance forms the nitrogen gas nozzle 70 (nitrogen gas supply means) for turning and supplying the nitrogen gas drawn through the building envelope of the skirt-board section 56 from the nitrogen gas dust 55 in the center of an inferior surface of tongue of Wafer W. Between the upper limit side of the skirt-board section 56, and the inferior surface of tongue of the base plate 60, the labyrinth packing 69 for preventing leakage of nitrogen gas is formed.

[0045] Thus, the configuration relevant to the base plate 60 and the configuration relevant to a shield 40 are the symmetry mostly about the horizontal plane containing the wafer W held among these.

[0046] The effluent and the exhaust air member 81 are arranged in the location of the method of the outside of radial of a shield 40, similarly, the effluent and the exhaust air member 82 are arranged in the location of the method of the outside of radial of the base plate 60, and these are supported by the upper cup 10 and the bottom cup 20 through the supporter material 83 and 84, respectively. According to contiguity/estrangement of the up-and-down cups 10 and 20, it deserts and, as for up-and-down effluent and exhaust air members 81 and 82, an effluent and a flueway 85 are formed among both in contiguity / the condition of having made these contacting mutually. As upper effluent and exhaust air member 81 have inlet 81a in which an effluent and a flueway 85 carry out opening toward a shield 40 side, it has path section 81b by which the cross section which intersects a hoop direction was formed in 1 ellipse form for about 4 minutes. On the other hand, lower effluent and exhaust air member 82 have path section 82b in which the cross section which intersects a hoop direction carried out opening to the upper part and which was mostly formed in the hemicycle so that the gas introduced from inlet 81a may produce a spiral air current, while receiving the effluent introduced from inlet 81a. Moreover, path section 82b, and the effluent and jet pipe 87 which were open for free passage are attached in the inferior surface of tongue of the effluent and the exhaust air member 82 of this bottom.

[0047] Moreover, labyrinth packing 88 is formed between the inner skin of the upper effluent and exhaust air member 81, and the peripheral face of a shield 40. Similarly, labyrinth packing 89 is formed between the inner skin of the lower effluent and exhaust air member 82, and the peripheral face of the base plate 60. Thereby, the ambient atmosphere from between a shield 40 and the base plates 60 can be exhausted efficiently. 90 is a seal member for combining airtightly up-and-down effluent and exhaust air members 81 and 82.

[0048] For delivery of the wafer W with a substrate carrier robot, the wafer elevator style 100 is formed in relation to the base plate 60. This wafer elevator style 100 has two or more support pins 101 which support Wafer W from a lower part, and the air cylinder 102 for making it go up and down this support pin 101.

[0049] Moreover, the rinse through the bulb RV 1 for rinses is supplied to the penetrant remover nozzle 48 as a penetrant remover from the rinse tank outside the etching reagent which minded the bulb EV1 for etching reagents from the etching-reagent tank outside drawing, or drawing. Similarly, the rinse through the bulb RV 2 for rinses is supplied to the penetrant remover nozzle 68 as a penetrant remover

from the etching reagent which minded the bulb EV2 for etching reagents from the etching-reagent tank, or a rinse tank. Furthermore, the nitrogen gas from the source of nitrogen gas supply outside drawing is supplied to the nitrogen gas dusts 35 and 55 respectively through the bulbs NV1 and NV2 for nitrogen gas.

[0050] Closing motion control of these bulbs EV1, EV2, RV1, RV2, NV1, and NV2 is performed by the control unit 95 containing a microcomputer etc. Moreover, Motors MU and ML, the elevator style 13, and an air cylinder 102 are also controlled by the control unit 95. In order to make the driver circuits 91 and 92 for driving Motors MU and ML especially carry out synchronous rotation of these motors MU and ML, a common control signal is given to them from a control unit 95.

[0051] Drawing 2 is the bottom view of a shield 40. Inferior-surface-of-tongue 40A of a shield 40 is making the 1st substrate opposed face which counters the top face of Wafer W, and six mediation supporter material 4 (the 1st mediation supporter material) is arranged at equal intervals along the hoop direction at the periphery section. This mediation supporter material 4 consists of spring materials of rubber or others, and in the front face which attends that wafer W, it has flat side 4a almost parallel to Wafer W, and taper side 4b which inclined so that the top face of Wafer W might be deserted as it goes to the core of Wafer W as shown in the expanded sectional view of drawing 4 .

[0052] Drawing 3 is the top view of the base plate 60. Top-face 60A of the base plate 60 is making the 2nd substrate opposed face which counters the inferior surface of tongue of Wafer W, and six mediation supporter material 6 (the 2nd mediation supporter material) is arranged at equal intervals along the hoop direction at the periphery section. That is, the mediation supporter material 6 is formed so that it may correspond to the mediation supporter material 4 by the side of a shield 40. This mediation supporter material 6 has back-face 6a which supports the periphery section of the inferior surface of tongue of Wafer W, and guidance standup side 6b which inclined so that it might fall as it starts from this back-face 6a in the location of the method approach of the outside of radial of the base plate 60 and goes to the method of the inside of radial as shown in the expanded sectional view of drawing 4 . This mediation supporter material 6 also consists of spring materials of rubber or others.

[0053] When delivery of the wafer W from the wafer elevator style 100 to the base plate 60 is performed, Wafer W is guided by guidance standup side 6b of the mediation supporter material 6 to back-face 6a, and is dropped. In this way, if the elevator style 13 drops the upper cup 10 after alignment of the wafer W is carried out to the base plate 60 and it is held, a shield 40 will also descend in connection with this. And in the process in which the upper cup 10 and the bottom cup 20 are close, taper side 4b of the mediation supporter material 4 by the side of a shield 40 touches the periphery section of the top face of Wafer W, and elastic deformation is carried out, turning and showing Wafer W to the center of rotation. At this time, the elastic deformation of the mediation supporter material 6 by the side of the base plate 60 also happens to coincidence. And after the upper cup 10 has been close with the bottom cup 20, elastic deformation of the mediation supporter material 4 and 6 is carried out, respectively, and it pinches the periphery section of Wafer W. At this time, the fixed spacing D1 is secured between inferior-surface-of-tongue 40a of a shield 40, and the top face of Wafer W, and the fixed spacing D2 is similarly secured between the inferior surface of tongue of Wafer W, and the top face of the base plate 60.

[0054] It outlines below about the whole down stream processing flowing.

[0055] When carrying in the unsettled wafer W to the processing chamber 1, a control unit 95 controls the elevator style 13, and raises the processing cup 10. In connection with this, the penetrant remover nozzle 48, various kinds of ducts 31 and 35, the effluent, the exhaust air member 81 which are prepared in relation to a shield 40 and this go up. in this way, the shield 40 -- alienation -- it is led to a location and the carrying-in path of Wafer W is secured between the upper cup 10 and the bottom cup 20 between an effluent and the exhaust air members 81 and 82 and between a shield 40 and the base plate 60.

[0056] The support pin 101 is raised until a control device 95 controls an air cylinder 102, passes further the passage hole (not shown) with which the upper limit of the support pin 101 was formed in the base plate 60 and results in delivery height higher than the mediation supporter material 6 (refer to drawing

4).
[0057] If the upper limit of the support pin 101 delivers and height is reached, it enters in the processing chamber 1, and on the support pin 101, a substrate carrier robot's substrate maintenance hand will set the unsettled wafer W, and will evacuate out of the processing chamber 1 after that.
[0058] Then, a control device 95 drops the support pin 101 until the upper limit of the support pin 101 results in downward evacuation height rather than the inferior surface of tongue of the base plate 60. In this process, Wafer W is dropped by guidance standup side 6b of the mediation supporter material 6 as mentioned above to back-face 6a.
[0059] Then, a control unit 95 controls the elevator style 13, and drops the upper cup 10. Thereby, the upper cup 10 is close to the bottom cup 20, and the inside of the processing chamber 10 becomes airtight. Moreover, at this time, a shield 40 will be led to the contiguity location close to the base plate 60, and the mediation supporter material 4 of a shield 40 and the mediation supporter material 6 of the base plate 60 will pinch the periphery section of Wafer W by six places. Furthermore, an effluent and the exhaust air members 81 and 82 are close, and an effluent and a flueway 85 are formed.
[0060] Furthermore, a control device 95 gives a drive control signal common to drivers 91 and 92, and carries out synchronous rotation of the motors MU and ML. However, Motors MU and ML rotate to an opposite direction mutually. By this, the up-and-down tumbling barrels 38 and 58 will rotate in the same direction, and the shield 40 and the base plate 60 which are being fixed to these tumbling barrels 38 and 58 will carry out synchronous rotation in one at the circumference of the vertical axis passing through each core. Therefore, the wafer W currently pinched between the base plate 60 and the shield 40 is in the condition held horizontally, and will rotate to the circumference of the vertical axis which passes along a core mostly.
[0061] Subsequently, a control unit 95 starts drug solution washing of Wafer W. That is, the etching reagent as a drug solution for washing is made to breathe out from each deliveries 48a and 68a of the penetrant remover nozzles 48 and 68 by carrying out Kaisei of the bulbs EV1 and EV2 for etching reagents. Thereby, an etching reagent is supplied from point-blank range towards the center of each of the top face of Wafer W, and an inferior surface of tongue. Since the supplied etching reagent is led to the method side of the outside of the radius-of-gyration direction according to the centrifugal force accompanying rotation of Wafer W, drug solution washing can be everywhere performed to the whole region of the vertical side of Wafer W as a result. In addition, the bulbs RV1 and RV2 for rinses are held during this drug solution washing period at a closing condition.
[0062] After an etching reagent is supplied only for fixed time amount defined beforehand, a control device 95 carries out Kaisei of the bulbs RV1 and RV2 for rinses while it closes the bulbs EV1 and EV2 for etching reagents and ends a drug solution washing process. By this, from the penetrant remover nozzles 48 and 68, rinses (pure water, ozone water, electrolysis ion water, etc.) will be supplied towards the center of the vertical side of Wafer W. In this way, the rinse process for flushing the etching reagent which exists in the vertical side of the wafer W after a drug solution washing process is performed.
[0063] After a rinse is supplied, only fixed time amount defined beforehand closes the bulbs RV1 and RV2 for rinses, and a control device 95 ends a rinse process for it. Then, a control device 95 gives the control signal for carrying out high-speed rotation of the motors MU and ML to drivers 91 and 92. Thereby, rotation of Wafer W is accelerated and the liquid component of the front face is shaken off according to a centrifugal force. In this way, a desiccation process is performed. A control device 95 carries out Kaisei of the bulbs NV1 and NV2 for nitrogen gas, and makes nitrogen gas supply to the vertical side of Wafer W from the nitrogen gas nozzles 50 and 70 in the case of this desiccation process. Thereby, since the air of the space of the small volume where it was restricted between the shield 40 and the base plate 60 is permuted by nitrogen gas by whether you are Sumiya, an oxide film [**** / un-] does not grow up to be the vertical side of the wafer W after washing processing.
[0064] After termination of a desiccation process, further, a control unit 95 stops rotation of Motors ML and MU, the upper cup 10 is raised by the elevator style 13, and after that, by the air cylinder 102, delivers the support pin 101 and is raised to height. In this condition, a substrate carrier robot will receive the wafer [finishing / washing and desiccation processing] W from the support pin 101, and

will take out out of the processing chamber 1.
[0065] In the early stages of a drug solution washing process, a rinse process, and a desiccation process, it is transmitted to the vertical side of Wafer W, and a drug solution or a rinse flows to a way outside Wafer W, passes along between the adjoining mediation supporter material 4 and 6, and jumps out outside further from Wafer W. This liquid that jumped out is received in an effluent and a flueway 85, and an effluent is carried out out of the processing chamber 1 through an effluent and a jet pipe 87. Moreover, by the compulsive exhaust air through an effluent and a jet pipe 87, Myst produced when a liquid collides with the mediation supporter material 4 and 6, or an effluent and exhaust air members 81 and 82 is discharged through an effluent, a flueway 85, and an effluent and a jet pipe 87, and is not led to the space of the upper and lower sides of Wafer W.
[0066] Moreover, the exhaust air through jet pipes 31 and 51 is always performed, and thereby, the particle resulting from sliding in bearings 37 and 57, the gear sections 41 and 61, etc. is carried away out of the processing chamber 1, and does not arrive at the front face of the wafer W between a shield 40 and the base plate 60.
[0067] He pinches from the upper and lower sides, and is trying to rotate a shield 40 and the base plate 60 in that condition as mentioned above by the mediation supporter material 4 and 6 which prepared the periphery section of Wafer W in the shield 40 and the base plate 60 according to this operation gestalt. Therefore, spacing D1 and D2 (refer to drawing 4) with the vertical side of Wafer W, a shield 40, and the base plate 60 is certainly made uniformly to two or more processing-object wafers. Therefore, uniform processing can be performed to two or more wafers.
[0068] Moreover, since the spacing D1 and D2 with the vertical side of Wafer W, a shield 40, and the base plate 60 is certainly prescribed by the mediation supporter material 4 and 6, it does not have a possibility that a shield 40 and the base plate 60, and Wafer W may collide. Therefore, it is easy to make small spacing D1 and D2 of a shield 40 and the base plate 60, and the vertical side of Wafer W. Then, it can prevent that surrounding particle adheres to the front face of Wafer W by making small enough these spacing D1 and D2. Moreover, since the space around Wafer W can be restricted effectively, the perimeter of this wafer W can be made into nitrogen-gas-atmosphere mind whether you are Sumiya. Thereby, washing processing of Wafer W can be performed good.
[0069] And since the vertical side of Wafer W is made to face the deliveries 48a and 68a of the penetrant remover nozzles 48 and 68 from the openings 47 and 67 of the center of the shields 40 and 60 which approached the vertical side of Wafer W very much, the penetrant remover path length from Deliveries 48a and 68a to the vertical side of Wafer W is very short. Therefore, a penetrant remover does not rebound on the front face of Wafer W. Moreover, the temperature change of the penetrant remover breathed out from Deliveries 48a and 68a is hardly produced. Thereby, processing of the wafer W by the penetrant remover by which temperature management was carried out can be effectively performed to profit.
[0070] Furthermore, since it is the configuration which supports Wafer W by pinching by the mediation supporter material 4 and 6 of the upper and lower sides of the periphery section of Wafer W and the complicated drive for operating the chuck pin which rotates with the base plate 60 as compared with the case where set up a chuck pin (attachment component) to the base plate 60, and it is made to grasp the end face of Wafer W by this chuck pin for example, is unnecessary, a configuration becomes very easy. Moreover, since there are few members which cut a wind as compared with the case where a chuck pin is used, there is little turbulence of the surrounding air current of a shield 40 and the base plate 60. Thereby, since generating of Myst, winding up of particle, etc. can be prevented effectively, the processing quality of Wafer W can be improved.
[0071] In addition, in order to pinch by the mediation supporter material 4 and 6 of the upper and lower sides of the periphery section of Wafer W, the relative rotation location of a shielding material 40 and the base plate 60 needs to be adjusted so that the location of the mediation supporter material 4 and 6 may have consistency. However, since a shield 40 and the base plate 60 start rotation where Wafer W is pinched, and they suspend rotation in the condition, if both rotation location is adjusted once, even if it does not readjust in principle, the condition that the location of the mediation supporter material 4 and 6

had consistency will be held after that.
[0072] Drawing 5 is an illustration-sectional view for explaining the configuration of the 2nd operation gestalt of this invention. In this drawing 5 , the same reference mark is attached and shown in a part equivalent to each part shown in above-mentioned drawing 1 thru/or above-mentioned drawing 4 . With this operation gestalt, mediation supporter material 6A of the shape of a semi-sphere projected toward the inferior surface of tongue of Wafer W in the periphery section of the base plate 60 is arranged along the hoop direction at six regular intervals at top-face 60A of the base plate 60, as shown in drawing 6 . Similarly, along the hoop direction, mediation supporter material 4A of the shape of six semi-sphere also projects a shield 40 to the inferior-surface-of-tongue 40A toward the top face of Wafer W, and it is formed in it at equal intervals. The mediation supporter material 4A and 6A is constituted from spring materials, such as rubber, by each. Also by this configuration, since the periphery section of Wafer W can be pinched from the upper and lower sides by the mediation supporter material 4A and 6A, the same operation and effectiveness as the 1st above-mentioned operation gestalt can be attained.
[0073] However, since there is no function to perform alignment of Wafer W, the direction of the above-mentioned 1st operation gestalt which can adjust the center of rotation of the core of Wafer W, the base plate 60, and a shield 40 is excellent in the semi-sphere-like mediation supporter material 4A and 6A with guidance standup side 6b and taper side 4b (refer to drawing 4).
[0074] Drawing 7 is an illustration-sectional view for explaining the configuration of the 3rd operation gestalt of this invention. In this drawing 7 , the same reference mark is attached and shown in a part equivalent to each part shown in above-mentioned drawing 5 or above-mentioned drawing 6 . With this operation gestalt, the guide member 110 is arranged by six regular intervals along the hoop direction at top-face 60A of the base plate 60 at the periphery section of the base plate 60, as shown at drawing 8 . This guide member 110 has the supporter 111 which has a flat side parallel to the top face of the base plate 60, and the interior 112 of a proposal which started from this supporter 11 to the method side of the outside of the radius-of-gyration direction of the base plate 60. The interior 112 of a proposal has slideway 112a formed so that it might become high as it goes to the above-mentioned method side of the outside of the radius-of-gyration direction. And mediation supporter material 6A of the shape of a semi-sphere which becomes a supporter 111 from a spring material is being fixed upward.
[0075] On the other hand, the attachment component 120 is arranged along the hoop direction at six regular intervals at the periphery section of the inferior surface of tongue of a shield 40 so that it may correspond to the guide member 110. Mediation supporter material 4A of the shape of a semi-sphere which becomes this attachment component 120 from a spring material is being fixed downward. And downward taper side 120a which becomes high is formed in the method side of the outside of the radius-of-gyration direction of the shield 40 of an attachment component 120 as it goes to the method side of the outside of radial [this]. The inclination of this taper side 120a is adjusted with the inclination of slideway 112a by the side of the guide member 110.
[0076] By this configuration, in case Wafer W is delivered to the base plate 60, it can show Wafer W to a position by slideway 112a of the guide member 110, and can drop. When making a shield 40 approach the base plate 60 and pinching the periphery section of Wafer W by the mediation supporter material 4A and 6A, since the interior 112 of a proposal of the guide member 110 is dedicated to the space of the lower part of taper side 120a of an attachment component 120, a possibility that the interior 112 of a proposal may interfere with an attachment component 120 does not have it.
[0077] This configuration can also attain the same operation effectiveness as the case of the 1st above-mentioned operation gestalt.
[0078] Drawing 9 is an illustration-sectional view for explaining the configuration concerning the modification relevant to supply with a penetrant remover and nitrogen gas. In this drawing 9 , the same reference mark is attached and shown in a part equivalent to each part shown in above-mentioned drawing 1 . In this modification, supply of the penetrant remover and nitrogen gas to the top face of Wafer W is performed using the nozzle 130 by which the nitrogen gas passageway 131 and the penetrant remover path 132 were formed in juxtaposition. Namely, delivery 131a which is open for free passage to the nitrogen gas passageway 131, and delivery 132a which is open for free passage to the

penetrant remover path 132 dissociate, and is formed in the nozzle 130, and these face in the center of the top face of Wafer W from the opening 47 of the center of a shield 40. After supplying a penetrant remover (an etching reagent or rinse) from the penetrant remover path 132, even if it breathes out nitrogen gas through the nitrogen gas passageway 131 by this, there is no possibility that the penetrant remover which remains near delivery 132a may become Myst-like, and may adhere to Wafer W.

[0079] Also in the configuration shown in drawing 1 , it can be said that the Myst yield has little direction in the configuration of drawing 9 R> 9 which separated the delivery greatly with a penetrant remover and nitrogen gas although there are few yields of Myst at the time of nitrogen gas supply, since a penetrant remover and nitrogen gas are not necessarily sharing the same path.

[0080] On the other hand, the nozzle 140 by which the nitrogen gas passageway 141 and the penetrant remover path 142 were formed in juxtaposition is used also about supply of the penetrant remover and nitrogen gas to the inferior surface of tongue of Wafer W. However, this nozzle 140 makes the opening 67 of the center of the base plate 60 face the delivery 145 shared between nitrogen gas and a penetrant remover, and is arranged, and the whorl room 150 which has earthenware mortar-like a base 151 and the cylinder wall surface 152 is formed down this delivery 145.

[0081] In the center of the base 151 of this whorl room 150, the upper limit of the penetrant remover path 142 is open for free passage. And an etching reagent can be supplied to the penetrant remover path 142 through the bulb EV2 for etching reagents, and a rinse can be supplied now to it through the bulb RV 2 for rinses. Moreover, the liquid in this penetrant remover path 142 has come to be able to carry out an effluent through a drain valve DV.

[0082] Drawing 10 is the sectional view expanding and showing the configuration near the whorl room 150, and drawing 11 is the sectional view seen from cutting plane line XI-XI of drawing 10 . The nitrogen gas passageway 141 is horizontally bent in near the side of the upper limit side 153 of the whorl room 150, and the nitrogen gas from the nitrogen gas passageway 141 is introduced into the whorl room 150 from the nitrogen gas inlet 154 along the hoop direction of the cylinder wall surface 152 along the upper limit side 153. In the whorl room 150, the discharge tube 155 droops from the periphery of a delivery 145 even in the location where only predetermined distance is lower than the nitrogen gas inlet 154.

[0083] In case an etching reagent or a rinse is supplied to the inferior surface of tongue of Wafer W, a drain valve DV is closed and Kaisei of the bulb EV2 for etching reagents or the bulb RV 2 for rinses is carried out. By this, a penetrant remover goes up through the penetrant remover path 142, and it passes along the whorl room 150, and is breathed out towards the inferior surface of tongue of Wafer W from a delivery 145. Although the gas of upper space is compressed a little rather than the lower limit of a discharge tube 155 with the rise of the oil level of the penetrant remover in the whorl room 150 since the bulb NV2 for nitrogen gas is closed at this time, the oil level of a penetrant remover does not go up even in the height of the nitrogen gas inlet 154.

[0084] When stopping the regurgitation of a penetrant remover and supplying nitrogen gas to the inferior surface of tongue of Wafer W, the bulb EV2 for etching reagents and the bulb RV 2 for rinses are closed by each, and Kaisei of the drain valve DV is carried out. In this condition, if Kaisei of the bulb NV2 for nitrogen gas is carried out, nitrogen gas will be introduced into the whorl room 150 from the nitrogen gas inlet 154 through the nitrogen gas passageway 141. At this whorl room 150, nitrogen gas forms a curled form air current, and serves to stuff into the penetrant remover path 142 the penetrant remover which remains on the cylinder wall surface 152 file bowl-like base 151. Therefore, there is no possibility that Myst of a penetrant remover may be led to the inferior surface of tongue of Wafer W.

[0085] Although a part of nitrogen gas led to the whorl room 150 enters to the penetrant remover path 142, since the inside of the processing chamber 1 is exhausted with jet pipes 31 and 51, most nitrogen gas will be led to a delivery 145 from a discharge tube 155, and will permute the ambient atmosphere of the space between the inferior surface of tongue of Wafer W, and the top face of the base plate 60.

[0086] As mentioned above, although some operation gestalten of this invention were explained, this invention can be carried out with other gestalten. For example, with an above-mentioned operation gestalt, although Motors MU and ML are formed, respectively for the rotation drive, in the condition of

a shield 40 and the base plate 60 of having pinched Wafer W, a shield 40 and the base plate 60 can transmit torque mutually by the mediation attachment components 4 and 6. Therefore, one side of the motors MU and ML does not need to be prepared.

[0087] Moreover, although the case where the mediation supporter material 4, 4A, 6, and 6A was constituted from a spring material was explained, a spring material does not necessarily need to constitute these mediation supporter material from each above-mentioned operation gestalt. However, in order to ensure maintenance of the wafer W under rotation, it is desirable to constitute mediation supporter material from a spring material.

[0088] Moreover, although the shield 40 gave the example by which a rise-and-fall drive is carried out with the above-mentioned operation gestalt, it may fix, a shield 40 may be constituted possible [rise and fall of the base plate 60], and you may be the configuration which both a shield 40 and the base plate 60 can go up and down. If either can be gone up and down at least, Wafer W can be held between a shield 40 and the base plate 60, and this maintenance can be canceled.

[0089] Furthermore, although the equipment which washes a wafer was taken for the example with the above-mentioned operation gestalt, this invention is applicable also to the equipment which can apply also to the equipment which performs processings other than washing, and processes the substrate of other classes, such as a glass substrate for liquid crystal displays, besides a wafer.

[0090] In addition, it is possible to perform design changes various in the range of the technical matter indicated by the claim.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the configuration of the substrate processor concerning 1 operation gestalt of this invention.
[Drawing 2] It is the bottom view of the shield of the above-mentioned substrate processor.
[Drawing 3] It is the top view of the base plate of the above-mentioned substrate processor.
[Drawing 4] It is the expanded sectional view showing the pinching condition of the wafer by mediation supporter material.
[Drawing 5] It is an illustration-sectional view for explaining the configuration of the 2nd operation gestalt of this invention.
[Drawing 6] It is the top view of the base member in the operation gestalt of the above 2nd.
[Drawing 7] It is an illustration-sectional view for explaining the configuration of the 3rd operation gestalt of this invention.
[Drawing 8] It is the top view of the base member in the operation gestalt of the above 3rd.
[Drawing 9] It is an illustration-sectional view for explaining the configuration concerning the modification relevant to supply with a penetrant remover and nitrogen gas.
[Drawing 10] It is the sectional view expanding and showing the configuration near the whorl room in the above-mentioned modification.
[Drawing 11] It is the sectional view seen from cutting plane line XI-XI of drawing 10 .
[Description of Notations]
4 Mediation Supporter Material
6 Mediation Supporter Material
13 Elevator Style
40 Shield
60 Base Plate
38 58 Tumbling barrel
42 62 Timing belt
48 68 Penetrant remover nozzle
91 92 Driver
95 Control Unit
MU, ML Motor

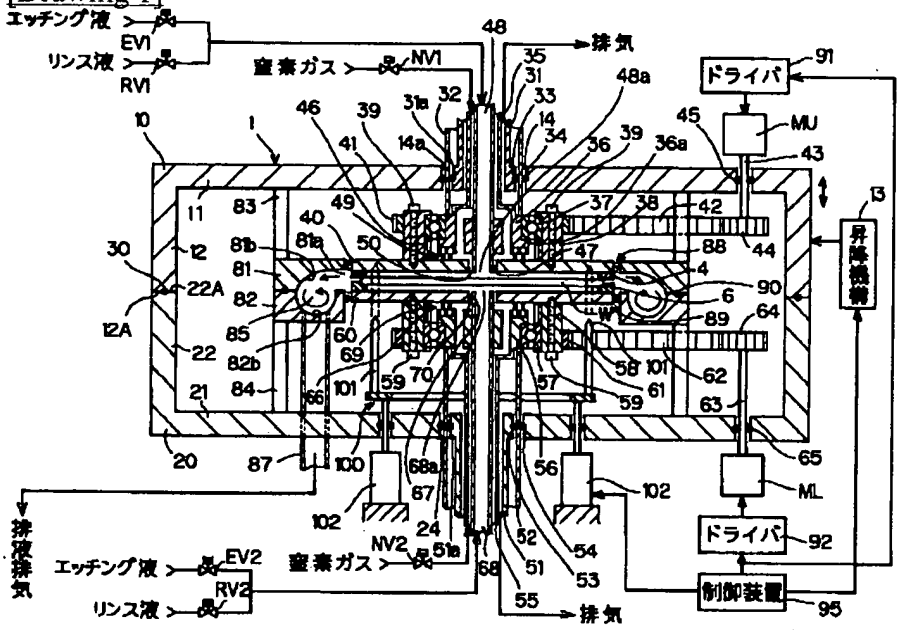
[Translation done.]

* NOTICES *

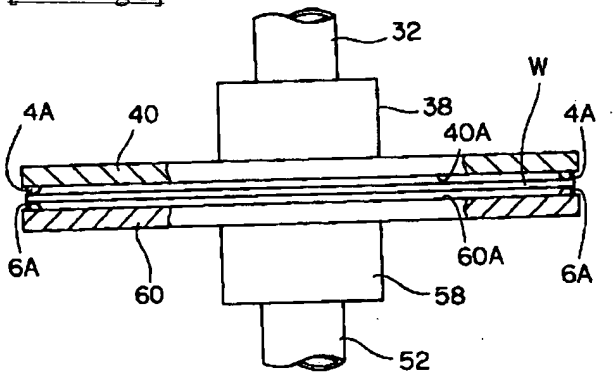
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

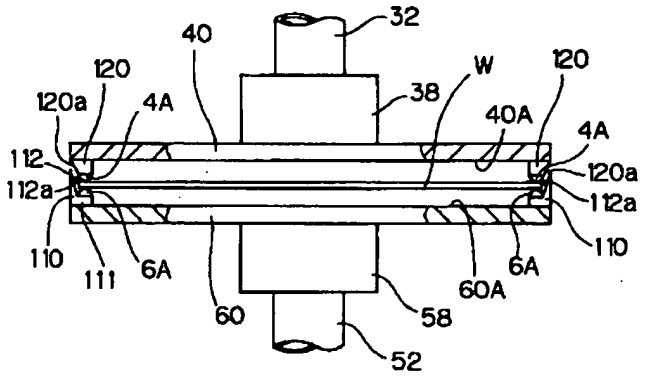
[Drawing 1]



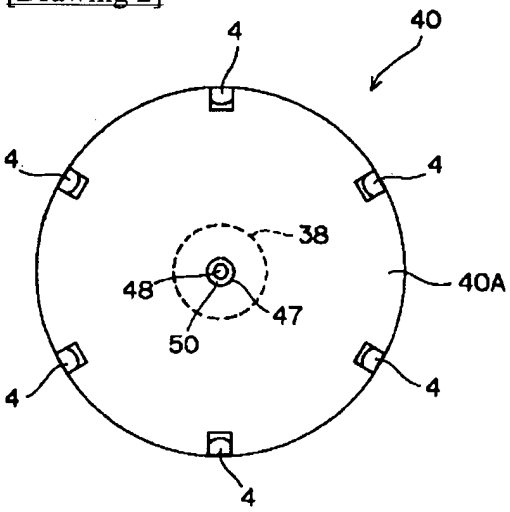
[Drawing 5]



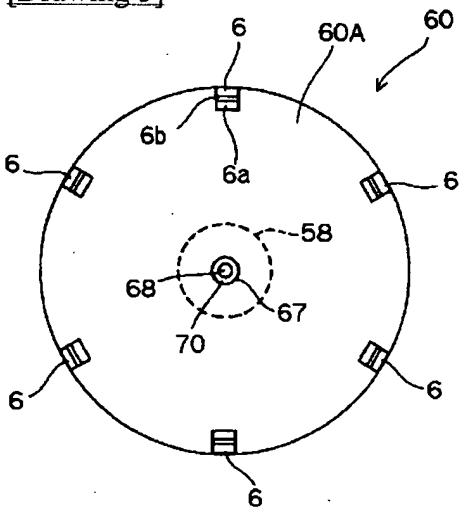
[Drawing 7]



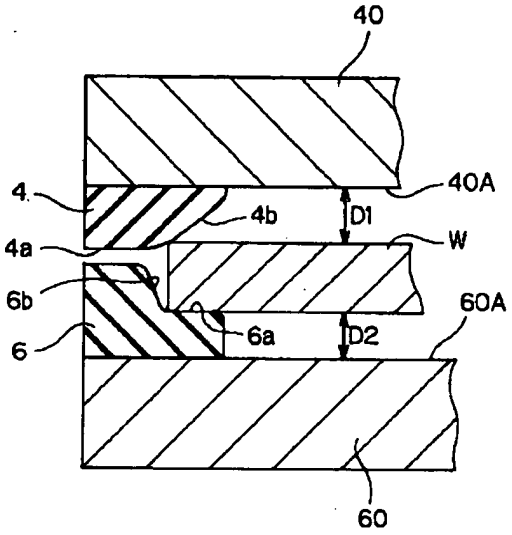
[Drawing 2]



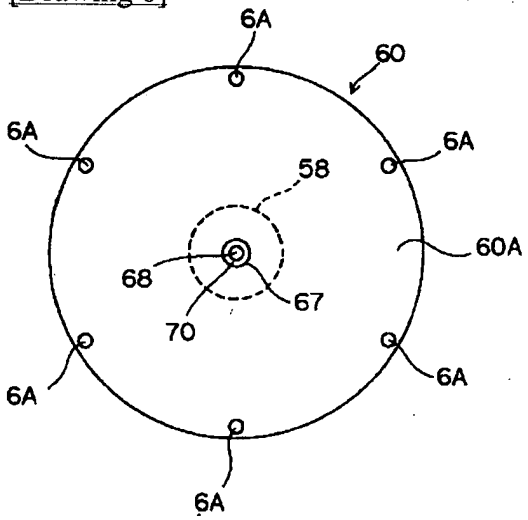
[Drawing 3]



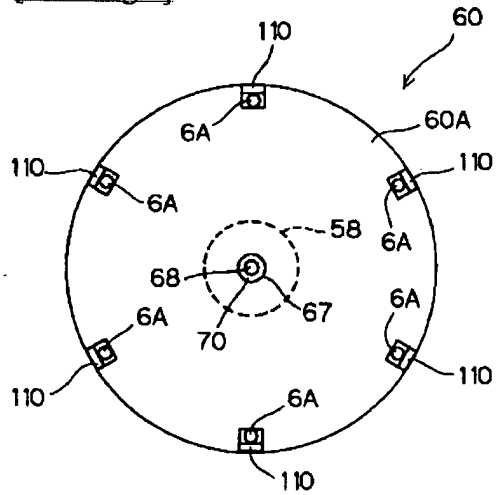
[Drawing 4]



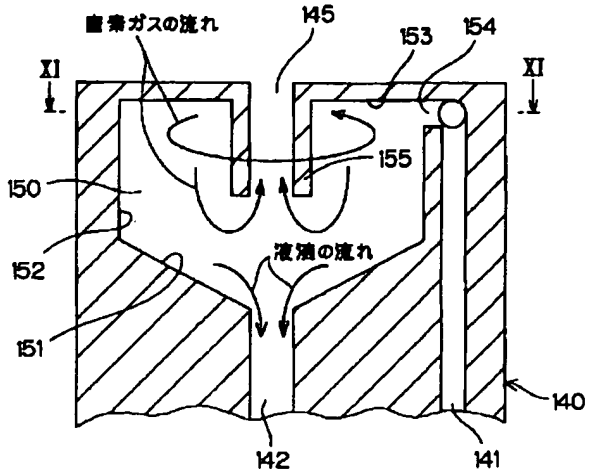
[Drawing 6]



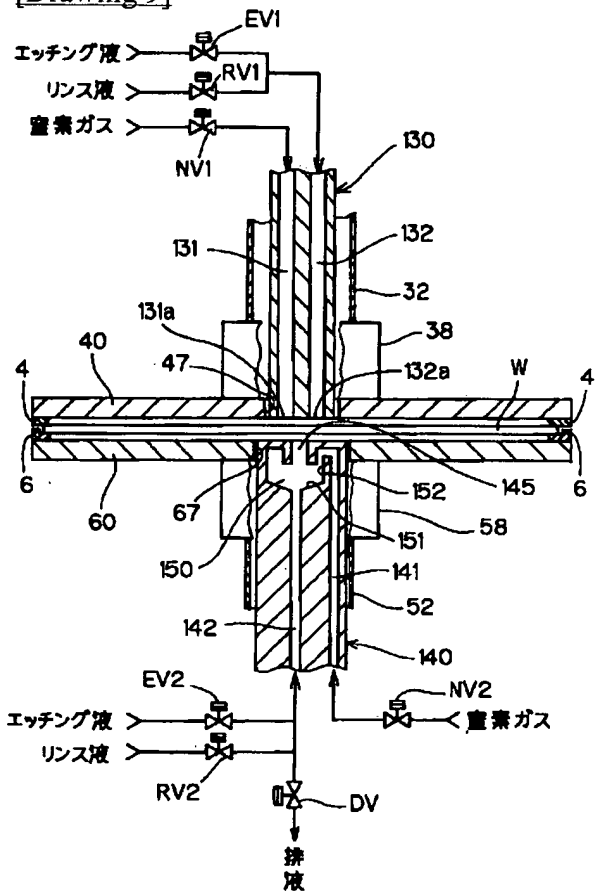
[Drawing 8]



[Drawing 10]



[Drawing 9]



[Drawing 11]